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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/517,314	03/02/2000	Chih-Chen Cho	M4065.0223/P223	5039

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EXAMINER

KANG, DONGHEE

ART UNIT PAPER NUMBER

2811

DATE MAILED: 10/01/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/517,314

Applicant(s)

CHO, CHIH-CHEN

Examiner

Donghee Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-11,13-17,25 and 27-39 is/are pending in the application.
- 4a) Of the above claim(s) 33-38 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3-11, 13-17, 25, 27-32 and 39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Prosecution Application

1. The request filed on August 28, 2002 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 09/517,314 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims **1, 3-4 & 9-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig.11 of Chiang et al (US 5,739,579) in view of Fig.9 of Chiang et al (US 5,739,579).

Chiang discloses a semiconductor structure comprising (Fig.11):

an insulator layer (22); a conductive plug (100) positioned within said insulator layer and formed of a single conductive material; a doped region (21) connected to said conductive plug (100); an etch-stop layer (23) located on said insulator layer and surrounding said plug, wherein said etch-stop layer comprises silicon nitride or silicon carbide; a non-conductive layer (101) having an etched via at least partially over said conductive plug, wherein said etches via is wider in diameter than said conductive plug; and a conductive connector (102) formed in said via in electrical contact with said plug. Chiang does not teach the conductive connector includes a first conductor layer and a

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second conductor layer. However, Chiang teaches in alternate embodiment Fig.9 the conductive connector includes a first conductor layer (60), which is made of TiN and a second conductor layer (61) made by copper. It is conventional to use copper with a barrier layer as a conductive interconnection layer instead of aluminum because copper has a lower resistivity than aluminum so as providing a higher speed. Thus it would have been obvious in the art at the time the invention was made to substitute aluminum of Chiang's device (Fig.11) with well-known copper/barrier layer taught by Chiang (Fig.9) since copper provides higher speed than aluminum and higher density in ICs. See Col.8, lines 55-67, Col.11, lines 12-48, & Col.14, line 65 – Col.15, line 3.

4. Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) and further in view of Wang et al (US 6,184,128).

Regarding claim 5, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising a silicon dioxide. Wang et al teach in Fig.7 the silicon dioxide layer acts as an etch-stop layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with a well known silicon dioxide as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Regarding claim 6, Chiang et al discloses the entire claimed invention, as applied to claim 1 above, except for non-conductive layer (etch-stop layer) comprising silicon nitride and silicon carbide. However, Wang et al teach in Fig.7 etch stop layer (13) includes the silicon nitride and silicon carbide layer (Col.5, lines 49-64).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the silicon nitride of Chiang's device with silicon nitride and silicon carbide layers as taught by Wang et al in order to provide the etch stop layer in the device. Furthermore, one of ordinary skill in the art would have recognized that the silicon nitride and silicon dioxide are both considered to be an art recognized functional equivalent for serving as an etch-stop layer for BPSG dielectric layer.

Moreover, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the etch-stop layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

5. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al (US 5,739,579) and further in view of Hong et al (US 6,008,117).

Chiang et al disclose substantially the entire claimed structure, as applied to claim 1 above, except for non-conductive layer comprises borophosphosilicate glass (BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. See also Col.3, lines 16-19.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the SiO₂ of Chiang's device with a conventional BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch rate than etch-stop layer. Furthermore, one of ordinary skill in the art would have recognized that the SiO₂ and BPSG are both considered to be art recognized functional equivalent for providing a dielectric layer and therefore an obvious expedient. Moreover, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

6. Claims **11, 15-17, 25, 27, 30-32 & 39** are rejected under 35 U.S.C. 103(a) as being unpatentable over Fig.11 of Chiang et al (US 5,739,579) in view of Fig.9 of Chiang et al (US 5,739,579) and further in view of Matsuura (US 5,598,027).

Regarding claims **11, 25, 27 & 32**, Chiang discloses a semiconductor structure comprising (Fig.11):

an active region in a substrate (21); a conductive plug (100) formed of a single conductive material positioned within an insulator layer (22) and provided over said active region, said conductive plug being electrically connected with said active region; an etch-stop layer (23) deposited on said insulator layer and around said conductive plug; an intermediate non-conductive layer (101) provided over said etch stop layer and

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having an etched via over said plug, wherein the etched via is being wider in diameter than said conductive plug; and a conductive layer disposed in and in contact with said conductive plug. Chiang does not teach the conductive layer includes a first conductor layer and a second conductor layer. However, Chiang teaches in alternate embodiment Fig.9 the conductive connector includes a first conductor layer (60), which is made of TiN and a second conductor layer (61) made of copper. It is conventional to use copper with a barrier layer as a conductive interconnection layer instead of aluminum because copper has a lower resistivity than aluminum so as providing a higher speed. Thus it would have been obvious in the art at the time the invention was made to substitute aluminum of Chiang's device (Fig.11) with well-known copper/barrier layer taught by Chiang (Fig.9) since copper provides higher speed than aluminum and higher density in ICs. See Col.8, lines 55-67, Col.11, lines 12-48, & Col.14, line 65 – Col.15, line 3.

Chiang does not teach the intermediate non-conductive layer having a first and a second etched via over said plug, wherein said second etched via is above and has a greater diameter than said first etched via. Matsuura teaches in Fig.1 forming a double (first and second) etched via (7) formed over a conductive plug (4), wherein said second etched via has a greater than said first etched via. Thus it would have been obvious in the art at the time the invention was made to incorporate the teaching of Matsuura into the Chiang's device since double etched via can be reduced a height of the ICs so as to form several interconnection layer without increasing a volume.

Neither Chiang nor Matsuura explicitly teach a processing unit which is coupled to a semiconductor device. It would have been obvious to one of ordinary skill in the art

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at the time the invention was made to have a processor unit in processor-based device, since the processor is required in the processor-based device to operate a device.

Regarding claims **15, 16, 30, & 31**, Chiang as modified by Matsuura teaches the first conductive layer and the second conductive layer comprise titanium nitride and copper, respectively.

Regarding claims **17 & 39**, Chiang as modified by Matsuura disclose the claimed invention except for a plurality of memory cells. It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a plurality of memory cells, since it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8.

7. Claims **13-14 & 28-29** are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang in view of Matsuura, as applied to claim 11 above, and further in view of Hong (US 6,008,117).

Chiang et al disclose substantially the entire claimed structure, as applied to claim 1 above, except for non-conductive layer comprises borophosphosilicate glass (BPSG). However, Hong et al teaches in Fig.1H the non-conductive layer disposed on the etch-stop layer comprises BPSG. *See also Col.3, lines 16-19.*

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the SiO₂ of Chiang's device with a conventional BPSG material as taught by Hong in order to provide a dielectric layer which has a less etch

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rate than etch-stop layer. Furthermore, one of ordinary skill in the art would have recognized that the SiO₂ and BPSG are both considered to be art recognized functional equivalent for providing a dielectric layer and therefore an obvious expedient. Moreover, it would have been obvious to one having ordinary skill in the art the invention was made to form the dielectric layer, *having the materials as claimed*, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

DHK
September 26, 2002

Steven Loh